Cambridge O Level

**Cambridge International Examinations**
Cambridge Ordinary Level

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|---|---|
| CANDIDATE NAME | |

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| CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | | | |

*3365325931*

**ENVIRONMENTAL MANAGEMENT** **5014/21**

Paper 2 **May/June 2018**

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

Study the appropriate source materials before you start to write your answers.
Credit will be given for appropriate selection and use of data in your answers and for relevant interpretation of these data. Suggestions for data sources are given in some questions.
You may use the source data to draw diagrams and graphs or to do calculations to illustrate your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **15** printed pages and **1** blank page.

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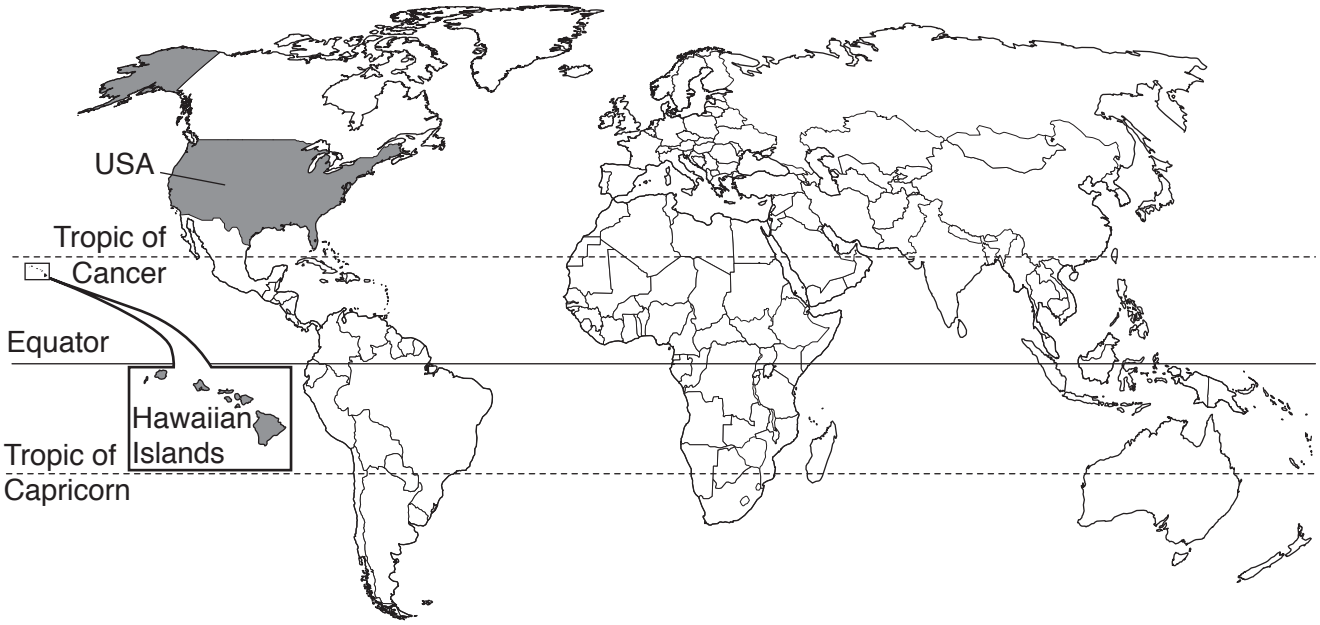
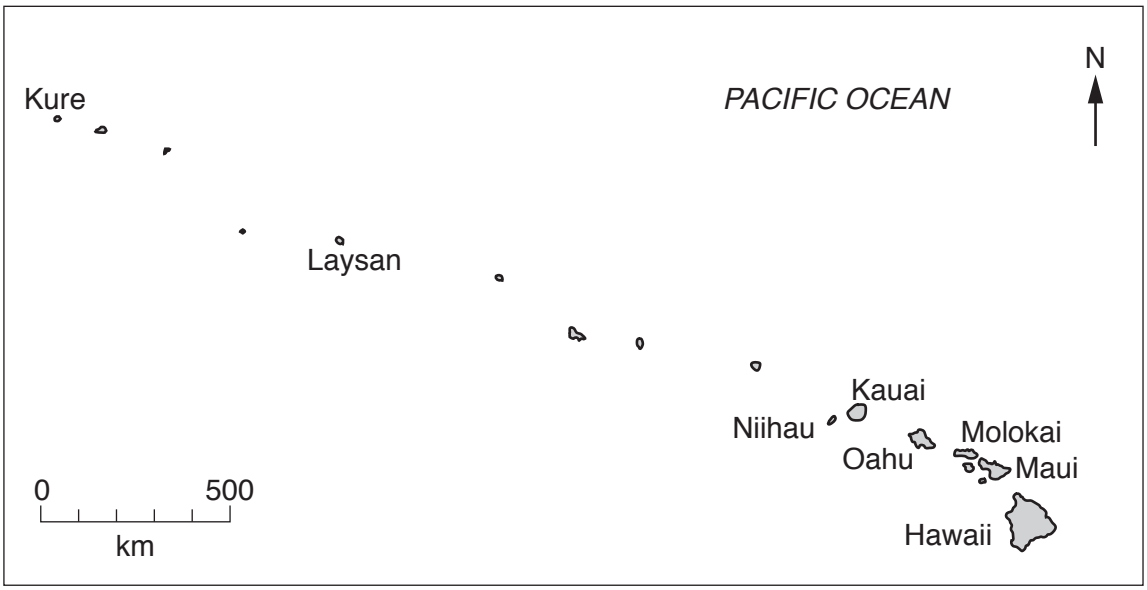
CAMBRIDGE International Examinations

**map of the world**




**map of Hawaiian islands**




**area of the state of Hawaii:** 28 311 $km^2$

**population:** 1.43 million (in 2015)

**children per woman:** 1.85

**life expectancy:** 81.3 years

**currency:** USD

**languages:** English, Hawaiian

**main economic activities:** agricultural production, fishing and tourism

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**1** Hawaii is a state of the USA; it is a long chain of volcanic islands. People only live on the larger islands. The small islands are uninhabited. Crops are grown on the lower slopes of the volcanoes. More than six million tourists visit this state every year.

**(a)** Use the map and scale to estimate the distance between

Oahu island and Laysan island ..... km

Hawaii island and Kure island ..... km
[2]

**(b)** The population of the four largest Hawaiian islands is shown in the table.

| island name | population in 2015 | estimated population in 2020 |
|---|---|---|
| Hawaii | 202 700 | 220 900 |
| Oahu | 976 200 | 1 003 700 |
| Kauai | 71 400 | 75 600 |
| Maui | 168 000 | 181 000 |
| total | 1 418 300 | ..... |

**(i)** Calculate the total estimated population in 2020.
Complete the table. [1]

**(ii)** Calculate the percentage of the total population that is expected to live in Oahu in 2020.
Give your answer to one decimal place.

Show your working.

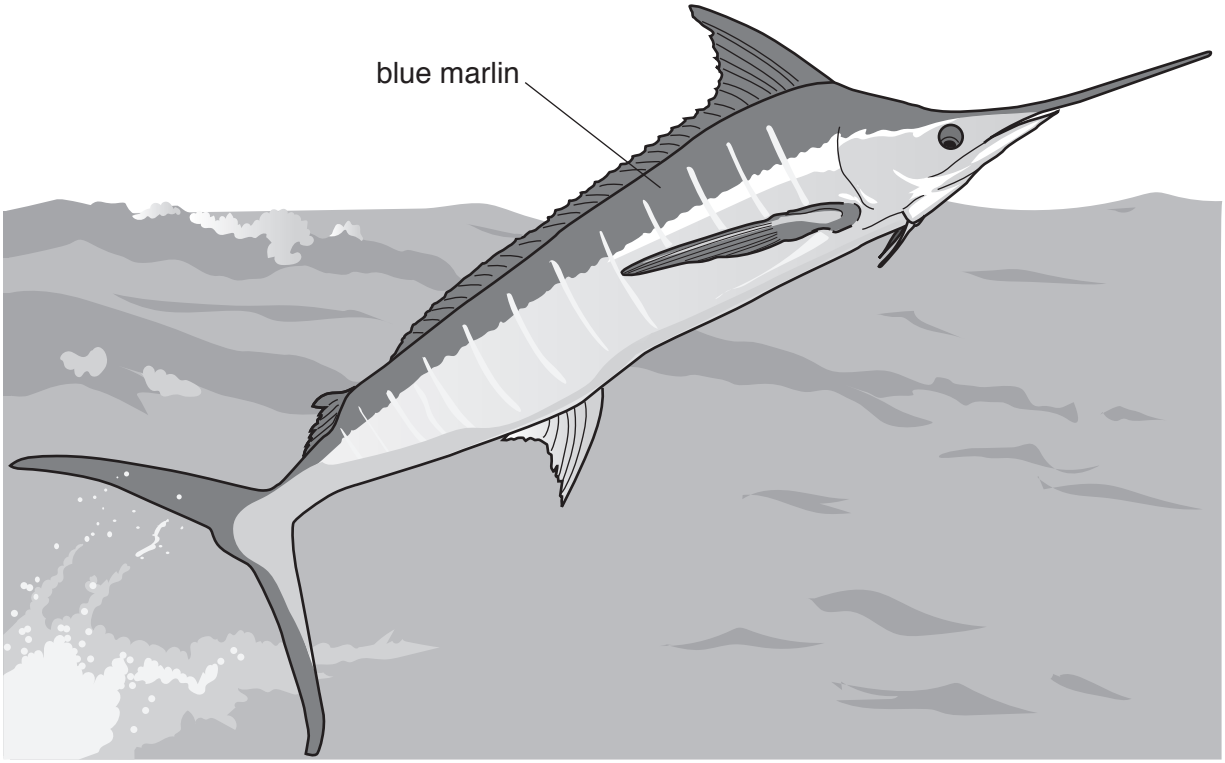
.....% [2]

**(iii)** List the island names in rank order of 2015 population from highest to lowest by completing the table.

| | island name |
|---|---|
| highest | ..... |
| ↓ | ..... |
| | ..... |
| lowest | ..... |

[2]

**(c)** More than six million tourists visit the Hawaiian islands each year. Many tourists go sport fishing for a large fish called the blue marlin.




These fish are caught out at sea by rod and line from boats hired by tourists.

A boat captain said

> In my experience,
> July is the best month
> to catch blue marlin and
> January is the worst.

A student wanted to find out more about the number of blue marlin caught in January and July. The student decided to ask boat captains how many blue marlin they were catching.

The student said

> I will go to the harbour and ask the boat captains
> of the first three boats that return to harbour. I will do this on three separate days
> in January and again in July.

**(i)** Draw a table the student could use to record the results collected in January.

[3]

**(ii)** Suggest **two** advantages of asking each boat captain the same question.

1 .....

.....

2 .....

.....
[2]

**(iii)** Female blue marlin are the most desirable sport fish. Many of these fish die after being caught by tourists. They are much larger than the male fish. Some scientists are worried that catching more female than male fish will damage the population of blue marlin.

Explain why catching female fish may damage the population of blue marlin.

.....

.....

.....

.....[2]

**(iv)** The blue marlin is a top carnivore in the marine ecosystem.

phytoplankton ⟶ zooplankton ⟶ small fish ⟶ large fish ⟶ blue marlin

The blue marlin may be in danger of being overfished.

Suggest what might happen to the population of large and small fish if the blue marlin are overfished.

Explain your answer.

large fish population .....

explanation .....

.....

small fish population .....

explanation .....

.....
[3]

**(v)** The authorities in Hawaii control the sport fishing activity to try to make this activity sustainable.

Describe the measures that can be taken to control sport fishing.

.....

.....

.....

.....

.....

.....

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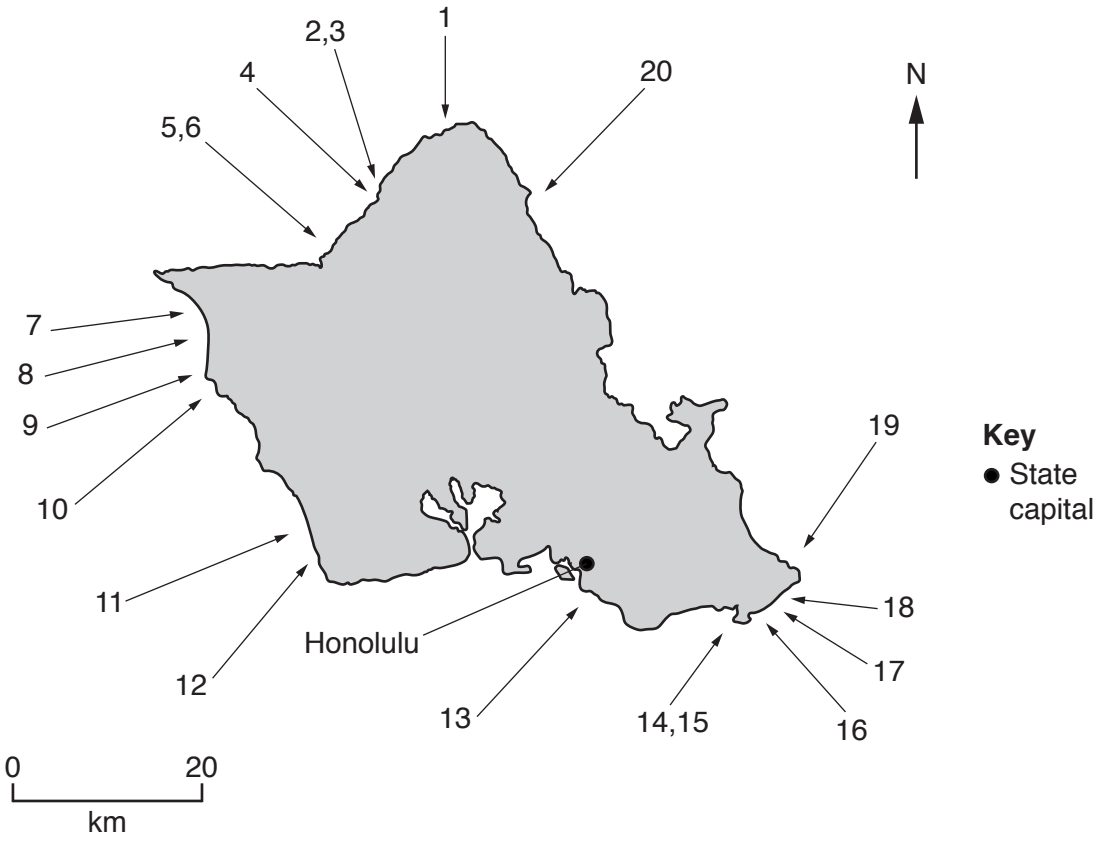
.....

.....

.....[5]

**(d)** Tourists also come to the Hawaiian islands to see the colourful fish living in lagoons. The main diving sites around the island of Oahu are shown on the map.

**Oahu diving sites**




**(i)** Suggest why a recent survey showed that diving site 20 has the least damage due to diving.

.....

.....

.....

.....[2]

**(ii)** The peacock grouper is a fish that was introduced to Hawaiian lagoons 65 years ago as a new source of food for humans. The population of peacock groupers increased rapidly. The peacock grouper feeds on a large number of young fish of many species. Unfortunately about 20% of these peacock groupers contain a poison that can make humans very ill. Now these fish are never eaten but are found in large numbers in all the lagoons around the islands.

Surveys of some lagoons indicate that the introduction of the peacock grouper has reduced biodiversity more than fishing.

What do you understand by the term *biodiversity*?

.....

.....[1]

**(iii)** In an attempt to control the peacock grouper, spear-fishing competitions are held regularly. All the fish caught are given to local farmers.

Suggest how the farmers could use the dead fish to increase crop growth.

.....

.....

.....

.....[2]

**(iv)** Are these spear-fishing competitions a good strategy for environmental management?

Explain your point of view.

.....

.....

.....

.....

.....

.....[3]

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**2** **(a)** The photograph shows an albatross and chick. The albatross is a bird that feeds on small fish caught near the surface of the sea. The material that the albatross birds cannot digest is formed into a pellet called a bolus. This bolus is brought up from the stomach and ejected. The albatross birds often mistake floating plastic pieces for their prey.

The tables show the results of a survey of the plastics found in some boluses from albatross nest sites on the Hawaiian islands Oahu and Kure.

| | **Oahu island** | |
|---|---|---|
| **bolus sample** | **number of plastic pieces** | **mass of plastic/g** |
| 1 | 18 | 3 |
| 2 | 21 | 5 |
| 3 | 16 | 5 |
| 4 | 18 | 8 |
| 5 | 19 | 8 |
| 6 | 16 | 6 |
| 7 | 15 | 4 |
| 8 | 12 | 1 |
| average | 17 | 5 |
| range | from 12 to 21 | from 1 to 8 |

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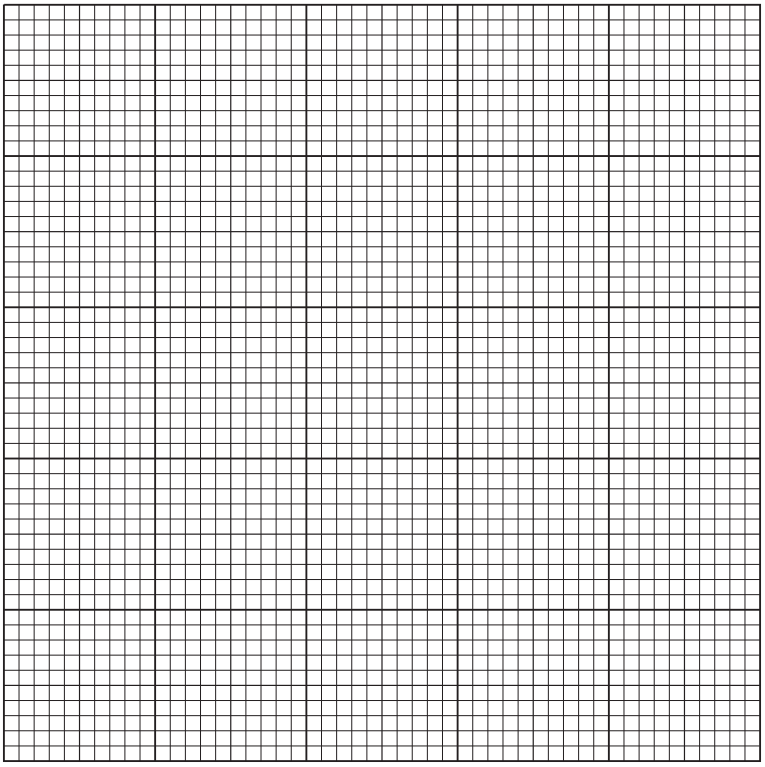
| | Kure island | |
|---|---|---|
| **bolus sample** | **number of plastic pieces** | **mass of plastic/g** |
| 1 | 54 | 85 |
| 2 | 83 | 40 |
| 3 | 90 | 15 |
| 4 | 61 | 41 |
| 5 | 101 | 34 |
| 6 | 72 | 10 |
| 7 | 53 | 17 |
| 8 | 62 | 54 |
| average | 72 | ..... |
| range | from ..... to ..... | from ..... to ..... |

**(i)** Complete the table for Kure island. [2]

**(ii)** Plot a bar graph of the average number of plastic pieces and the average mass of plastic for both islands. Include a key.



[4]

**(iii)** What conclusions could you draw from this survey?

.....

.....

.....

.....[2]

**(b)** Albatross spend months out at sea. Scientists have found that the average wind speed across the Pacific Ocean increased from 24.8 to 27.4 km per hour between 1988 and 2011. When the winds are stronger, these birds lose weight. As a result the birds breed less successfully.

**(i)** Calculate the percentage increase in average wind speed between 1988 and 2011.

Show your working.

.....% [2]

**(ii)** Suggest reasons why the birds lose weight and breed less successfully.

.....

.....

.....

.....[2]

**(iii)** Suggest **one** possible cause for the increase in average wind speed over the Pacific Ocean.

.....

.....[1]

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**(c)** Large numbers of waste plastic pieces are found on all the beaches of Oahu. Some of the most polluted beaches are in the north east of the island.

A student visited a beach and collected a few items of waste plastic. These are shown in the photograph.

The student noticed that there were more plastic bottle tops than plastic bottles on the beach.

**(i)** Suggest **two** possible reasons for this.

1 .....

.....

2 .....

.....
[2]

**(ii)** The student decided to perform a survey of one beach in the north and one beach in the south of Oahu island. The following method was used.

**Step 1** Lay out a 30 m tape along the top of the beach.

**Step 2** Place a 0.25 $m^2$ quadrat at the 5 m mark on the tape.

**Step 3** Remove all the waste plastic pieces in the quadrat. This is sample one.

**Step 4** Repeat steps 2 and 3 at the 10, 15, 20 and 25 m marks on the tape.

**Step 5** In the laboratory, separate each sample into the different types of waste plastic.

**Step 6** Record the results in a table.

Name the type of sampling used in this method.

.....[1]

The results are shown in the table.

| | | **average mass in a 0.25 $m^2$ quadrat** | |
|---|---|---|---|
| | | south beach / g | north beach / g |
| **type of plastic** | bottle tops | 9 | 21 |
| | bottles | 28 | 50 |
| | toothbrushes | 18 | 29 |
| | other plastic waste | 45 | 125 |
| | total | 100 | 225 |

The student estimated the area of each beach covered in plastic waste.

south beach 1500 $m^2$ north beach 2250 $m^2$

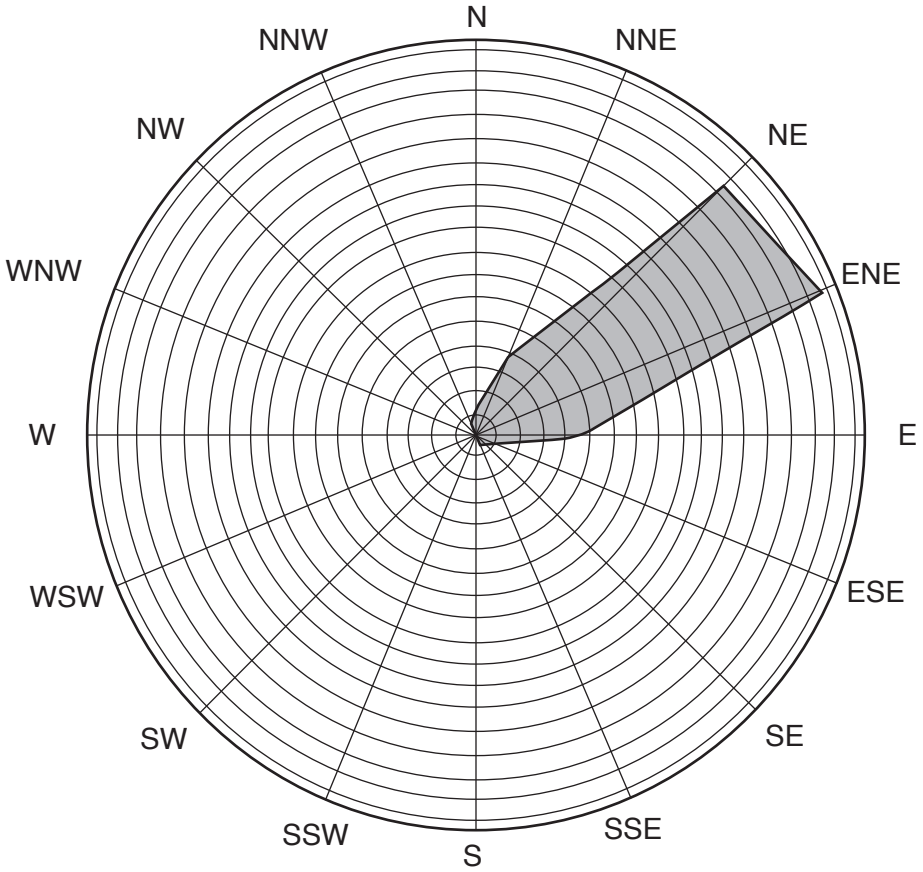
**(iii)** Calculate an estimate of the total mass, in kg, of plastic waste on each beach.

Show your working.

south beach .....kg

north beach .....kg
[3]

**(iv)** The student found information about the wind direction during the year for Oahu island.




How does this information explain the difference in mass of the plastic waste between the north and south beach?

.....

.....[1]

**(v)** Suggest **one** other possible reason for the difference in mass of the plastic waste between the north and south beach.

.....

.....[1]

**(vi)** Most toothbrushes are made of plastics that cannot be recycled.

State **two** different methods of disposing of toothbrushes to prevent them entering oceans.

1 .....

2 .....
[2]

**(d)** Most plastic waste in the ocean eventually breaks down to form microplastic particles. These can only be seen using a microscope. Microplastics have been found in the tissues of many marine organisms.

Explain why high concentrations of microplastics are often found in organisms at the top of marine food chains.

.....

.....

.....

.....

.....

.....[3]

**(e)** Plastic waste in the oceans is an international environmental problem. Governments want to reduce the mass of plastic waste in the oceans by 2030.

Suggest why it will be difficult to reduce this problem by 2030.

.....

.....

.....

.....

.....

.....

.....

.....[4]

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